

Risks of Acute Injury for Responders to Hazardous Materials Releases in Oregon 1993-2005

Oregon Hazardous Substances Emergency Events Surveillance (HSEES) System
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Introduction

"... one of the attributes of a good safety culture that is a 'must' is 'learning from incidents'."

M. Sam Mannan, Director, Mary Kay O'Conner Process Safety Center, Texas A&M University

What does safety culture have to do with HSEES? Both learn from incidents by determining how the incident happened; what processes, chemicals, and people were involved; that systematic records of incidents are necessary to learn from incidents; that analysis of collected records on incidents can help us plan to avoid incidents and injuries.

In an attempt to describe the acute illnesses, injuries and deaths experienced by employees, first responders, and the general public that result from hazardous substances emergencies, the Agency for Toxic Substances and Disease Registry (ATSDR) developed a tracking and follow-up system in 1989. The resulting tracking system is known as the Hazardous Substance Emergency Events Surveillance System or HSEES and is currently implemented in 14 states. This system was needed because existing databases were not designed to assess the health impact of hazardous substance emergencies. HSEES does not have regulatory authority which affords it the unique ability to provide feedback on incidents to increase safety among responders, employees, and the public. The information collected by HSEES can be used to decrease the number and severity of release incidents and the morbidity and mortality due to incidents.

HSEES Objectives

The objectives of the HSEES system are:

1. To characterize hazardous substances emergency incidents in Oregon.
2. To describe acute illness, injury and death associated with releases.
3. To identify risk factors associated with incidents and adverse effects.
4. To develop strategies for reduction of adverse health effects of emergency incidents.

Sources of Incident Reports

Responders and other persons at the scene make reports to agencies that send reports to HSEES. On-scene reports can come from fire fighters, HazMat teams, law enforcement officers, company safety and health staff, Departments of Transportation, Environmental Quality, or Public Works, or from news media. Agency reports to HSEES are made within hours to weeks for most reports. With these reports in hand, the HSEES investigators contact persons who were at the scene for more detailed information on the incident.

Information on Incidents Needed and Utilized by HSEES

Useful information on incidents includes: Date, time, exact location; identity of substance, amount released; if anyone was decontaminated and if so was it done at the scene or at a medical facility; was an evacuation ordered, who was evacuated, how many people were evacuated, and how long did the evacuation last? Was a shelter-in-place ordered?

Useful information on injuries or illness associated with the incident includes: treatment at scene, transport, hospitalization; symptoms; age; sex; distance from release; if a responder is injured, what type of responder and whether and what kinds of personal protective equipment were used.

Overall HSEES Results 1993-2005

Oregon's Hazardous Substances Emergency Events Surveillance System (HSEES) has been tracking releases of non-petroleum hazardous substances and their acute health effects in Oregon since 1992. Between 1993 and 2005, Oregon HSEES logged 2679 hazardous material incidents into its database. During these events, 3328 hazardous materials were released. The number of substances released per incident ranged from 1 to 34. During 15% of the 2679 HSEES incidents (399 incidents), 1340 persons experienced symptoms associated with these incidents and were defined as victims. The number of victims per incident ranged from 1 to 85. Eighty six percent (86%) of victims (1159/1340) were affected during incidents where only one hazardous substance was released. Victims were classified as members of the general public, employees of affected industries, responders, or students at school. Employees were most frequently affected during hazardous material releases (57% of victims), the general public (including students at school) were second most frequently affected (34% of victims), and responders made up the remaining 9% of victims.

HSEES Results on Injuries to Responders 1993-2005

This report focuses on the subset of hazardous substance release events where acute adverse effects were experienced by responders to the incidents. Out of the total of events tracked from 1993-2005, 51 events occurred where responders experienced and reported symptoms of adverse health effects. 116 responders were adversely affected during those 51 hazardous material release events. Responder victims are categorized into 6 groups, as seen in Table 1.

Table 1. Types of Injured Responders - Oregon HSEES incidents - 1993-2005

Type of Responder	Number	Percent
Police officer	33	28%
Career Firefighter (ff)	25	22%
Volunteer ff	2	2%
Unspecified ff	20	17%
Emergency Medical Services (EMS) personnel	6	5%
Unspecified responder	30	26%
Total	116	100%

The severity of injuries experienced in incidents during this time period is shown in Table 2. During this time period, 48 people were treated at the scene of the incident, 35 were treated at a hospital and released, two were treated at a hospital and were admitted to the hospital, one was observed at the hospital but received no treatment, 2 were seen by a private physician within 24 hours of the event,

Table 2. Severity of Injuries to Responders - Oregon HSEES incidents 1993-2005

Severity of Injury	Number	Percent
Treated on scene	48	41%
Treated@hospital, Not Admitted	35	30%
Symptoms within 24hrs report by official	24	21%
Death	3	3%
Seen by private doc w/in24 hrs	2	2%
Treated@hospital, Admitted	2	2%
Observed@hospital, Not treated	1	1%
Unknown	1	1%
Total	116	100%

24 experienced adverse effects within 24 hours that were reported by an official. There were three deaths. Of these, two deaths occurred on scene or on arrival at hospital, and 1 death occurred after arrival at the hospital. The three deaths were associated with fires where hazardous chemicals were released but the deaths do not appear to have resulted directly from exposure to the chemicals.

A total of 244 substances were released during the 51 incidents in which responders were injured. During most incidents, only one chemical was released. Carbon monoxide was the most frequently released chemical, followed by chlorine, ammonia, and sulfuric acid (battery acid).

The symptoms most frequently reported by responders in these incidents were respiratory system problems (67); gastrointestinal problems (24) (includes nausea and vomiting); eye irritation (17); central nervous system (CNS) symptoms (16). (Each victim may report multiple symptoms.)

Conclusions and Recommendations:

Responders make up only 9% of the victims of HSEES identified incidents in Oregon. However, many of the responder injuries associated with the hazardous substance emergency incidents in Oregon can be prevented. Many symptoms experienced could be prevented by effective use of personal protective equipment (PPE).

As has been noted in previous Oregon HSEES reports^{1,2}, the injuries most frequently experienced by responders, as well as employees are respiratory irritation and CNS symptoms. These symptoms indicate that personal protective equipment may not prevent responders from exposure to hazardous substances if it is not used, is used improperly, or is the wrong equipment for the situation. This could be the result of inadequate training or equipment. For PPE to be effective, responders must be adequately trained in proper use of the equipment.

Among responders, firefighter victims appear to be more frequent (41%) than other types of responders, but firefighters respond more frequently to these incidents than other types of responders. Law enforcement officers make up nearly a third of responder victims. This could indicate that law enforcement may not be adequately equipped or trained to respond to hazardous materials incidents.

We were unable to determine whether injured responders had relatively more or less hazmat training than uninjured responders because this information is often unknown to the reporting agencies or people on-scene providing information on these incidents to Oregon HSEES. Furthermore, the HSEES system does not enumerate the total numbers of responders to hazmat events, so we do not have baseline information on uninjured responders for comparison.

Based on the data we present here, our recommendations relate to preventing exposure to hazardous substances released in incidents through the use of personal protective equipment:

Prevention of responder injuries may be achieved by:

- periodically revisiting the types of PPE being used by responders
- periodically revisiting how, when, and where that PPE is being used
- initial and refresher training for all responders in the appropriate use, care and maintenance of PPE
- reminding responders that only those with proper PPE should enter a scene or they too could become a victim

References Cited:

¹Hazardous Substances Emergency Events Surveillance System, Cumulative Report 2002-2003, July 2005, Oregon Department of Human Services.

²Hazardous Substances Emergency Events Surveillance System, Cumulative Report 1998-2001, January 2003, Oregon Department of Human Services.

Appendix: Definitions Used for the HSEES system

A hazardous substance release is eligible for inclusion if it is uncontrolled or illegal and requires removal, cleanup, or neutralization according to federal, state, or local law; threatened releases are included if actions are taken to protect public health (e.g. evacuation). In order for an incident to be included in this surveillance system's database, it should have involved an acute (short term) release, not a chronic release, of one or more hazardous substances. Incidents where petroleum is the only substance released are excluded due to the CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) Petroleum Exclusion clause.

A hazardous substance is any substance which might reasonably be expected to cause injury or death to an exposed person.

A victim is anyone who reported symptoms associated with the incident within 24 hours or who died as a result of the incident.

Symptoms reported are categorized into 12 groups: respiratory irritation, gastrointestinal distress, shortness of breath, eye irritation, headache, skin irritation, dizziness or other CNS symptoms, heart problems, chemical burns, heat stress, and trauma.

Acknowledgement:

This report was supported by funds from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) trust fund and the Office of Terrorism Preparedness and Emergency Response of the Centers for Disease Control and prevention (CDC), provided to the Oregon Department of Human Services under a cooperative agreement [#U61/ATU074151 and 096966] from the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services.